

CLAIMS

1. A device for transmitting motion between the rotor (14,114,214,314) of a synchronous permanent-magnet motor (10) and the working part 5 (32,132,232,332,432), characterized in that it comprises at least two motion transmission couplings (37,39,137,139,237,239,337,339,437,439) which mutually cooperate in a kinematic series, each coupling being constituted by at least one driving element (37,39,137,139,237,239,337,339,437,439) which is eccentric with respect to the rotation axis and is rigidly coupled to a component (14,114,214,314) 10 of the motion transmission system and by at least one driven element (39,41,139,141,239,241,339,341,439,441), which is also eccentric with respect to the rotation axis and is rigidly coupled to the component (32,132,232,332,432) arranged kinematically after the preceding one, the angle covered by the elements 15 of each coupling being, as a whole, less than a round angle, the intermediate components of the kinematic transmission having both a driven element and a driving element for receiving the motion from a preceding one and transmitting it to a subsequent one.

2. The device according to claim 1, characterized in that said motion transmission couplings are toothed, each coupling being constituted by at least one driving tooth (37,39,137,139,237,239), which is eccentric with respect to the rotation axis and is rigidly coupled to a component of the motion transmission system (14,114,214,314), and by at least one driven tooth (39,41,139,141,239,241,339,341,439,441), which is also eccentric with respect to the rotation axis and is rigidly coupled to the component (32,132,232,332,432) that 20 kinematically follows the preceding one.

3. The device according to claim 2, characterized in that it is composed of two couplings which mutually cooperate in a kinematic series, a first one of said couplings being constituted by a first tooth (37,137) which is rigidly coupled to the rotor (14,114) of a motor and by a second tooth (39,139) which is rigidly coupled 25 to an annular element (40,140) which can rotate freely with respect to said rotor

(14,114), a second one of said couplings being composed of said second tooth (39,139) and a third tooth (41,141) which is rigidly coupled to the working part (32,132).

4. The device according to claim 2, characterized in that it is composed of two
5 couplings which mutually cooperate in a kinematic series, a first one of said
couplings being constituted by two first teeth (237) which are rigidly coupled to
the rotor (214) of a motor in diametrically opposite positions, and of two second
teeth (237) which are rigidly coupled, likewise in diametrically opposite positions,
to an annular element (238) which can rotate freely with respect to said rotor, a
10 second one of said couplings being composed of said second teeth (239) and of
two third teeth (241) which are also diametrically opposite and are rigidly coupled
to the working part (232).

5. The device according to claim 2, characterized in that it is composed of four
couplings which mutually cooperate in a kinematic series, a first one of said
15 couplings being constituted by a first tooth (337) which is rigidly coupled to the
free shaft (319) of a motor and of a second tooth (339) which is rigidly coupled to
an annular element (340) which can rotate freely with respect to said free shaft
(319), a second one of said couplings being composed of said second tooth (339)
and of a third tooth (341) which is rigidly coupled to the working part (332), a
20 third one of said couplings being composed of a fourth tooth (343) which is rigidly
coupled to the rotor (314) of said motor and of a fifth tooth (345) which is rigidly
coupled to an annular element (344) which moves freely with respect to said free
axis, a fourth one of said couplings being composed of said fifth tooth (345) and of
a sixth tooth (346) which is rigidly coupled to said free shaft (319).

25 6. The device according to claim 3, characterized in that said motion
transmission couplings are arranged in an axial hollow body (34) which is rigidly
coupled to said working part (32) and is closed by a cover (35).

7. The device according to claims 3 and 6, characterized in that said first tooth
(37) protrudes from a tang (38) which is keyed on the end of said shaft (19), said
30 first tooth (37) being arranged eccentrically with respect to said shaft (19) and

constituting a driving tooth for said second tooth (39) which protrudes axially from an annular element (40) which can rotate freely in said hollow body (34) with respect to said shaft (19) and to said hollow body (34), said second tooth (39) having an extension which allows it to make contact with said first tooth (37) and 5 with said third tooth (41) which protrudes from the internal wall of the hollow body (34).

8. The device according to claim 7, characterized in that said first tooth (37) has a radial extension which partially affects the internal space of said hollow body (34), the radial extension of said second tooth (39) affecting the region between 10 said tang (38) and the external wall of said hollow body (34), providing clearances which allow free movement, said second tooth (39) having an axial extension which allows it to make contact with said first tooth (37) and with said third tooth (41), said third tooth (41) protruding radially from the internal wall of said hollow body (34) to the vicinity of the external profile of said first tooth (37).

15 9. The device according to claim 3, characterized in that said motion transmission couplings comprise a first tooth (137) which is rigidly coupled to an axial tang (138) which protrudes from a tip flange (117b) of said rotor (114), said annular element (140) from which said second tooth (139) protrudes being arranged so as to surround said shaft (119) and so that it can rotate freely, the 20 extension of said second tooth (139) being such that it can make contact with said first tooth (137) and with said third tooth (141) which protrudes from another annular element (142) which is rigidly coupled to said shaft (119).

10. The device according to claim 9, characterized in that the axial extension of said first tooth (137) partially affects the extension of said tang (138), the 25 remaining part being affected by said annular element (140), from which said second tooth (139) protrudes.

11. The device according to claim 9, characterized in that said third tooth (141) occupies the radial space provided externally with respect to said first tooth (137).

12. The device according to claim 4, characterized in that said couplings are 30 arranged in an axial hollow body (234) which is rigidly coupled to said working

part (232) and is closed hermetically by a cover (235).

13. The device according to claims 4 and 12, characterized in that said two first teeth (237) protrude in a diametrically mutually opposite configuration from a first annular element (238) which is keyed to the shaft (219) of a motor, said first teeth 5 (237) radially and partially affecting the space inside said hollow body (234), said first teeth (237) constituting driving teeth for said two second teeth (239) which protrude axially from a second annular element (240) which can rotate freely in said hollow body (234) with respect to said shaft (219) and to said hollow body (234), said second teeth (239) having an extension which allows them to make 10 contact also with two third teeth (241) which protrude radially from the internal wall of said hollow body (234) in the region left free by said first teeth (237).

14. The device according to claim 13, characterized in that said first teeth (237) are arranged in axially offset positions and in that said second teeth (239) are shaped so as to have parts whose radial extension affects all of the region between 15 said tang (238) and the external wall of the hollow body (234), providing clearances which allow free movement, said second teeth (239) having an axial extension which allows them to make contact with said first teeth (237) and with said third teeth (241) which protrude radially from the internal wall of said hollow (234) in axially offset positions.

20 15. The device according to claim 5, characterized in that two of said four motion transmission couplings are arranged in an axial hollow body (334) which protrudes from said working part toward said rotor and is closed by a cover (335).

16. The device according to claims 5 and 15, characterized in that said first tooth protrudes from a tang which is keyed to the end of said free shaft, said first tooth (337) being arranged eccentrically with respect to said shaft (319) and 25 constituting a driving tooth for said second tooth (339) which protrudes axially from an annular element (340) which can rotate freely in said hollow body (334) with respect to said shaft (319) and said hollow body (334), said second tooth (339) having an extension which allows it to make contact with said first tooth (337) and with said third tooth (341) which protrudes from the internal wall of the 30

hollow body (334), the other two of said four motion transmission couplings comprising said fourth tooth (343), which is rigidly coupled to an axial tang (342) which protrudes from a tip flange (317b) of the rotor (314) of said motor, so as to surround said free shaft (319), said annular element (344) from which said fifth tooth (345) protrudes being arranged so that it can rotate freely, the extension of said fifth tooth (345) being such that it can make contact with said fourth tooth (343) and with said sixth tooth (346) which protrudes from another annular element (347) which is rigidly coupled to said shaft (319).

17. The device according to one or more of the preceding claims, characterized in that at least one of said teeth (39) is composed of an internal supporting part (39a) which is made of rigid plastics and of two mutually opposite external parts (39b) which are overmolded on the internal part (39a), are made of elastomeric material, and form the surfaces for contact with the other teeth.

18. The device according to one or more of the preceding claims, characterized in that said cover (35,335) closes said hollow body (347,334) so that a hermetic seal is provided therein.

19. The device according to one or more of the preceding claims, characterized in that a slight interference is provided between the mutually moving parts, producing a friction engagement.

20. The device according to one or more of the preceding claims, characterized in that in said hollow body (34,334) there is a viscous fluid which has lubricating, impact-damping and noise-deadening functions.

21. The device according to claims 3 and 6, characterized in that said first tooth (37) protrudes from a tang (38) which is keyed to the end of said shaft (19), said first tooth (37) being arranged eccentrically with respect to said shaft (19) and constituting a driving tooth for said second tooth (39) which protrudes axially from an annular element (40) which can rotate freely in said hollow body (34) with respect to said shaft (19) and to said hollow body (34), said second tooth (39) having an extension which allows it to make contact with said first tooth (37) and with said third tooth (41) which protrudes from the face of said cover (35) which is

directed toward the inside of the hollow body (34).

22. The device according to claim 21, characterized in that said first tooth (37) has a radial extension which partially affects the internal space of said hollow body (34), the radial extension of said second tooth (39) affecting the region between 5 said tang (38) and the external wall of said hollow body (34), providing clearances which allow free movement, said second tooth (39) having an axial extension which allows it to make contact with said first tooth (37) and with said third tooth (41), said third tooth (41) protruding radially from a position which is proximate to the external profile of the cover (35) to the vicinity of the external profile of said 10 annular element (40).

23. The device according to one or more of the preceding claims, characterized in that said working part is an impeller (32,132,232,332,432) with curved vanes of a centrifugal pump.

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